SCIENCE

FRIDAY, OCTOBER 5, 1888.

NOTWITHSTANDING THE EMPHATIC warnings of all experienced Arctic navigators, and the difficulties encountered on the 'Alert' expeditions, the projected route from England through Hudson Strait to Fort Churchill continues to be discussed in England and Canada; and quite recently the establishment of a line of steamers on this route was advocated by no less an authority than Commodore A. H. Markham, in a lecture delivered before the Royal Geographical Society. As he failed, however, to disprove any of the objections raised against the practicability of this route, which are chiefly founded on the always imminent danger of Fox Channel ice, his remarks fail to convince us. There is no doubt that powerful but small steamers can accomplish the journey annually with comparative safety, but this is far from being sufficient to make Hudson Strait a practicable trade-route. The premium on this route would have to be enormously high on account of the great number of dangers to navigation, and at all seasons the steamers would be liable to long delays. Sir Charles Tupper, who was present at this discussion, did not take as favorable a view as Markham, while Dr. Rae condemned the plan as wholly untenable. It seems somewhat surprising to see it again revived after its impracticability appeared to have been thoroughly proved by the results of the Canadian Hudson Bay expeditions.

A LESSON IN COMMERCIAL GEOGRAPHY.

SIR C. W. WILSON, in his presidential address to the geographical section of the British Association, dwelt upon the importance of commercial geography and its bearings upon the economic welfare of England. He gave a sketch of the history of the world's trade, and thus outlined one of the most important branches of commercial geography. His remarks on the value of this study, although referring to England, are well worth being remembered. "My object has been," he said, "to draw attention to the supreme importance to this country of the science of commercial geography. That science is not confined to a knowledge of the localities in which those products of the earth which have a commercial value are to be found, and of the markets in which they can be sold with the greatest profit. Its higher aims are to divine, by a combination of historical retrospect and scientific foresight, the channels through which commerce will flow in the future, and the points at which new centres of trade must arrive in obedience to known laws. A precise knowledge of the form, size, and geological structure of the globe; of its physical features; of the topographical distribution of its mineral and vegetable products, and of the varied forms of animal life, including man, that it sustains; of the influence of geographical environment on man and the lower animals; and of the climatic conditions of the various regions of the earth, — is absolutely essential to a successful solution of the many problems before us. If England is to maintain her commanding position in the world of commerce, she must approach these problems in the spirit of Henry the Navigator, and by high scientific training fit her sons to play their part like men in the coming struggle for commercial supremacy. The struggle will be keen, and victory will rest with those who have most fully realized the truth of the maxim that 'knowledge is power.'"

His lucid method of treating the questions of commercial geography will be seen from his interesting remarks on the Suez Canal, which are the more interesting, as they suggest a comparison to the effects of a canal through the American Isthmus.

"The opening of the Suez Canal, by diverting trade from the Cape route to the Mediterranean, has produced, and is still producing, changes in the intercourse between the East and the West which affect this country more nearly, perhaps, than any other European state. The changes have been in three directions.

"First, An increasing proportion of the raw material and products of the East is carried direct to Mediterranean ports, by ships passing through the canal, instead of coming, as they once did, to England for distribution. Thus Odessa, Trieste, Venice, and Marseilles are becoming centres of distribution for Southern and Central Europe, as Antwerp and Hamburg are for the North; and our merchants are thus losing the profits they derived from transmitting and forwarding Eastern goods to Europe. It is true that the carrying-trade is still, to a very great extent, in English hands; but should this country be involved in a European war, the carrying-trade, unless we can efficiently protect it, will pass to others, and it will not readily return. Continental manufacturers have always been heavily handicapped by the position England has held since the commencement of the century, and the distributing trade would doubtless have passed from us in process of time. The opening of the canal has accelerated the change, to the detriment of English manufactures, and consequently of the national wealth; and it must tend to make England less and less each year the emporium of the world. We are experiencing the results of a natural law that a redistribution of the centres of trade must follow a re-arrangement of the channels of commerce.

"Second, The diversion of traffic from the Cape route has led to the construction of steamers for special trade to India and the East through the canal. On this line coaling stations are frequent, and the seas, excepting in the Bay of Biscay, are more tranquil than on most long voyages. The result is, that an inferior type of vessel, both as regards coal-stowage, speed, endurance, and seaworthiness, has been built. These 'canal wallahs,' as they are sometimes called, are quite unfitted for the voyage round the Cape, and, should the canal be blocked by war or accident, they would be practically useless in carrying on our Eastern trade. Since the canal has deepened, they have improved, for it has been found cheaper to have more coal-stowage, but they are still far from being available for the long voyage round the Cape. Had the canal not been made, a large number of fine steamers would gradually have been built for the Cape route, and, though the sailing-ships which formerly carried the India and China trade would have held their own longer, we should by this time have had more of the class of steamer that would be invaluable to us in war-time; and our trade would not have been liable, as it is now, to paralysis by the closing of the canal.

"Third, Sir William Hunter has pointed out, that, since the opening of the canal, India has entered the market as a competitor with the British workman; and that the development of that part of the empire as a manufacturing and food-exporting country will involve changes in English production which must for a time be attended by suffering and loss. Indian trade has advanced by rapid strides, the exports of merchandise have risen from an average of fifty-seven millions for the five years preceding 1874 to eighty-eight millions in 1884, and there has been an immense expansion in the export of bulky commodities. Wheat, which occupied an insignificant place in the list of exports, is now a great staple of Indian commerce, and the export has risen since 1873 from one and three-quarters to twenty-one million hundredweights. It is almost impossible to estimate the ultimate dimensions of the wheat trade, and it is only the forerunner of other trades in which India is destined to compete keenly with the English and European producers.

"The position in which England has been placed by the opening of the canal is in some respects similar to that of Venice after the discovery of the Cape route; but there is a wide difference in the

spirit with which the change in the commercial routes was accepted. Venice made no attempt to use the Cape route, and did all she could to prevent others from taking advantage of it: England, though by a natural instinct she opposed the construction of the canal, was one of the first to take advantage of it when opened, and, so far as the carrying-trade is concerned, she has hitherto successfully competed with other countries."

It is hardly possible to imagine what the effect of the American canal will be. Its influence is likely to be undervalued in Europe, as it will undoubtedly far more benefit the United States than European states. It will undoubtedly cause a revolution of the Eastern carrying-trade, and wrest from England's hand the profit obtained by distributing many Eastern goods over Europe and America.

The importance of geography, and more especially of commercial geography, has recently been emphasized by many English writers, and nowhere has this science more ably been advocated than in C. W. Wilson's address, from which we quoted above. If this science is important to England, it is even more important to us who have to develop the unknown resources of our vast territory. There can be no doubt that from an intelligent pursuit of this science great benefits would accrue to the welfare of our country.

THE LOCATION OF THE NICARAGUA SHIP-CANAL.

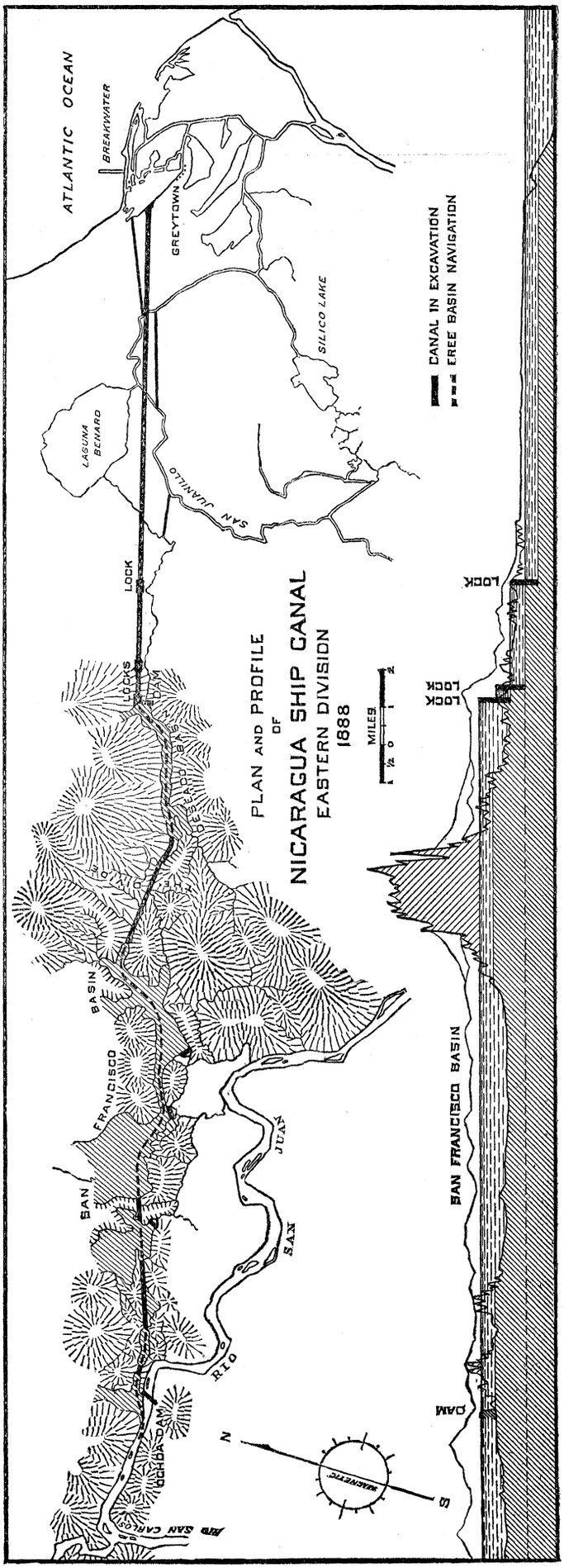
THE result of the surveys for the final location of the Nicaragua Canal, just completed by the Nicaragua Canal Construction Company, are highly satisfactory, and confirm with marked precision the great advantages, in both a financial and engineering point of view, claimed for the route recommended after the survey of 1885. Limited time and insufficient force for extensive field-work made a portion of that survey preliminary in its character; and, while the route selected was regarded as perfectly practicable, yet there were important details of construction and possibilities for improvements which could only be definitely settled by a more exhaustive examination of the newly traversed ground.

It has been the object of the last surveying expedition to eliminate all those doubtful elements, and to perfect the final plans for the work, from the Atlantic to the Pacific, before the scheme is finally presented to the public by the promoters of the enterprise.

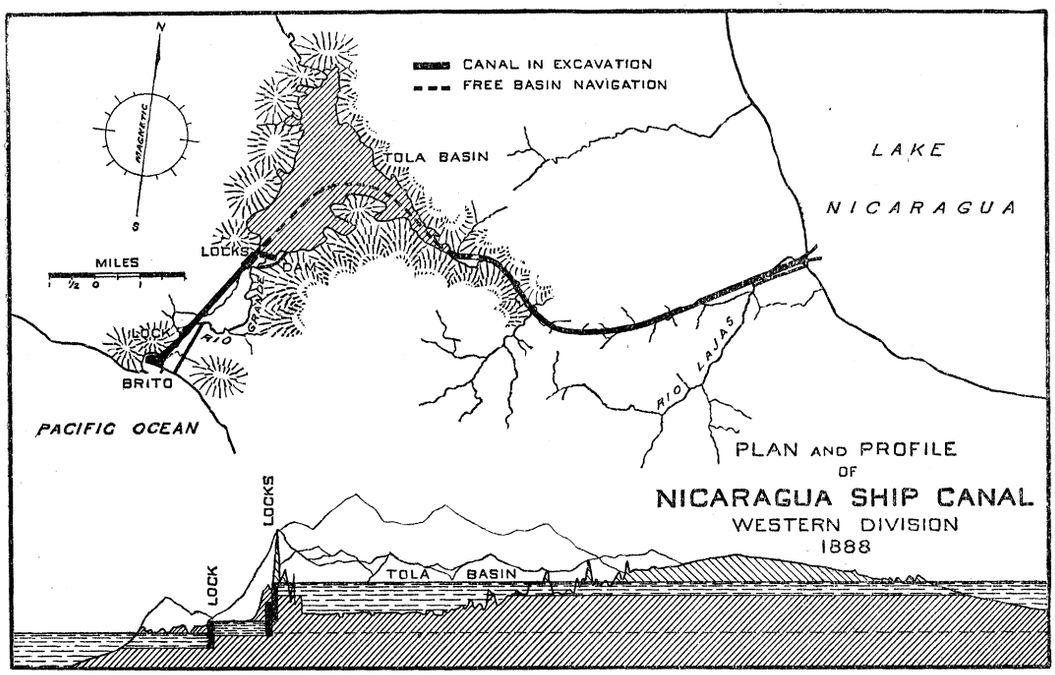
The work accomplished is highly creditable to the Construction Company. No expense or personal efforts have been spared to bring out the whole truth; and the detailed drawings representing the entire route, the geological specimens, the results of many borings of the ground, and much other valuable information bearing on the subject, now in possession of the company, bear testimony to the sound and honest intention of the promoters of this great enterprise not to go before the public until they are fully prepared to answer all questions, and to show with unusual accuracy the probable cost of the entire work.

The recent surveys extended over the whole ground; and after discarding those routes, or portions of routes, possessing the least merit, the whole force of the expedition was concentrated on those two presenting the greatest facilities for the construction of the canal. The difference between these two routes was confined to that portion extending from Greytown to the dam at Ochoa, there being no difference of opinion as to the best location between this latter point and the Pacific. Two routes had been suggested from Ochoa to Greytown, — one, the result of the survey of 1885, and called the 'upper route' on account of its striking feature of extending the summit or lake level across the basin of the river San Francisco and the 'eastern divide' to within a short distance of Greytown; the other, or 'lower route,' the result of the survey of 1872–73, extending through the lower valleys, and in close proximity to the river San Juan, to the divergency of the stream San Juanillo, an outlet of the San Juan River, and thence by a direct line to Greytown. Both routes have been re-examined and located with the same care, and with that precision which seems to control the work of the company; and a careful comparison of the results obtained shows the superiority of the upper route.

As now finally adopted, the location does not differ in general direction, controlling features, or total length, from that of 1885; but the last, more minute surveys have established beyond a doubt



the practicability of important improvements, which were only suggested as possibilities after the previous, more preliminary survey, and which will materially contribute to reduce the cost of the work by increasing the length of free navigation through basins, and proportionally increasing the capacity of the canal with a marked reduction of the working-expenses.



The route extends from Greytown, on the Atlantic, to Brito, on the Pacific, a distance of 169.67 miles, divided as follows: —

	Free Navigation.	Canal in Excavation.
From Greytown to the Deseado basin	–	12.37
Deseado basin	4.00	–
From Deseado basin to San Francisco basin	–	3.07
San Francisco and Machado basins	11.00	1.73
River San Juan	64.00	–
Lake Nicaragua	56.50	–
From Lake Nicaragua to Tola basin	–	8.22
Tola basin	5.28	–
From Tola basin to Brito	–	3.50
Total miles	140.78	28.89

The Deseado and Tola basins are new features brought out by the last location, as well as an increase of 2.13 miles in the length of free navigation in the San Francisco and Machado basins: in other words, the last location has reduced the length of canal in excavation from 40.3 to 28.89 miles, or 11.41 miles, and has increased the free navigation by that same distance; while the summit level has been extended from 144.8 miles to 153.8 miles.

It will require some time to complete the estimates of cost on the new location; but it may be safely stated that at least ten per cent will be gained in the total cost based on the survey of 1885, which is $64,036,197, including twenty-five per cent for contingencies.

THE BROOKLYN INSTITUTE.

RATHER more than fifty years ago a library association was formed in the city of Brooklyn, which grew in scope and usefulness, until in 1843 its charter was amended, and the name changed to that of the Brooklyn Institute. Courses of lectures were delivered from time to time, including in the list of speakers such men as Agassiz, Dana, Gray, Henry, Torrey, Guyot, and Cooke. Several important bequests made the institute financially strong, and its public hall was a favorite place of social gathering, aside from its main purpose of public instruction.

As time advanced and Brooklyn grew in size, the Academy of Music and other public buildings were erected, and the institute building waned in popularity. In 1867 the directors found it advisable to remodel the interior at an expense of thirty thousand dollars, which necessitated a mortgage on the building. Since that time, until quite recently, the entire income from its endowment fund has been absorbed in payment of the interest and principal of this debt. Final payment on the mortgage was made early in 1887.

The property now consists of the institute building and land, near the entrance to the great bridge, a library of fifteen thousand volumes, and endowment funds to the value of forty-six thousand dollars. The income from this is now applied to the purpose for which it was originally intended, and about a year ago the institute began upon a new era of activity.

One part of the endowment fund, bequeathed in 1851 by Augustus Graham, is devoted to the support of a limited course of Sunday-evening lectures on 'The Power, Wisdom, and Goodness of God as manifested in his Works.' In accordance with this requirement, lectures were delivered last winter by Sir J. William Dawson of Montreal, and by Dr. Alexander Winchell of the University of Michigan. Another part of the Graham fund is for the support of lectures on scientific subjects on other evenings of the week, and without specific restriction of topic. An introductory course of six lectures on astronomy was given last autumn by Prof. C. A. Young of Princeton. This was followed during the winter by another course, including topics in physics, geology, astronomy, and architecture. The lecturers were Messrs. George W. Plympton, W. LeConte Stevens, William C. Peckham, Franklin W. Hooper, and Garrett P. Serviss, of Brooklyn, and Dr. J. S. Newberry of New York.

Meanwhile steps had been taken with a view to the organization of a scientific society, with the Brooklyn Institute as its home. A meeting for this purpose was held in February, 1888, resulting in the adoption of by-laws and the formation of a council. Of this, Dr. Charles E. West was elected president, and W. LeConte Stevens secretary. Soon afterward the Brooklyn Microscopical Society and the American Astronomical Society became merged in the Brooklyn Institute as special departments of that body. The by-laws provide for departments in every branch of science, including anthropology, architecture, astronomy, botany, chemistry, en-

gineering, entomology, fine art, geography, geology, microscopy, mineralogy, photography, physics, and zoölogy. The associate members of the institute thus constitute a federation of independent departments; but a single admission-fee being required for associate membership, while each member has the privilege of joining as many departments as may be suggested by his individual tastes. For the origination of this plan, as well as for the burden of the work of organization, the credit is due chiefly to Mr. F. W. Hooper, of the Adelphi Academy, Brooklyn.

Aside from the meetings of departments, general meetings of the associate members are periodically held in connection with a course of public lectures. The opening lecture of the first course was given last April by Mr. W. LeConte Stevens, who was followed in successive weeks by Messrs. Robert Spice, George M. Hopkins, and Garrett P. Serviss. The season was closed with an exhibition by the department of microscopy, which was largely attended and in every way successful. The attendance at the public lectures was at first about three hundred, but grew to more than five hundred with the progress of the season.

Departments of entomology and of physics have been organized in addition to those already incorporated in the institute, and others will soon be started in chemistry, mineralogy, and botany. The department of physics held its first meeting on the evening of Sept. 26, when Mr. G. M. Hopkins exhibited a variety of apparatus, largely of his own device, illustrating centrifugal motion and the gyroscope. This was followed by a discussion of the latter instrument introduced by Mr. W. LeConte Stevens and participated in by various other members of the department.

The public lecture course for the coming winter has been already arranged, the opening lecture, on the 11th of October, being by Mr. Bradford of New York, the well-known artist and arctic explorer. Harvard, Yale, Columbia, and the scientific departments at Washington are well represented in the list of lecturers. S.

THE AGASSIZ SEASIDE ASSEMBLY.

AT the May meeting of the New Jersey Assembly of the Agassiz Association, held at Rutgers College, New Brunswick, N.J., it was decided to hold a seaside assembly, open not only to members of the Agassiz Association generally, but to all persons interested in the study of natural science. A committee was appointed, with power to make all necessary arrangements. Asbury Park was selected as the place, and the week beginning with Aug. 6 as the time, for the meeting; and Educational Hall was secured for the purpose. Circulars were sent to all the chapters in New England and the Middle States, and also to many persons interested in scientific studies, who were not members of the association. The assembly met on the day appointed, in Educational Hall, Asbury Park. The opening lecture was delivered by Harlan H. Ballard, president of the Agassiz Association, and it was a most inspiring introduction to a week of very successful and delightful work. The mornings of the remaining days of the week were devoted to field-excursions in botany and entomology, the former under the guidance of the Rev. L. H. Lighthipe, and the latter under the Rev. G. D. Hulst, the State entomologist of New Jersey. Tuesday afternoon was devoted to the examination and analysis of plants, many of which, belonging to the 'pine-barrens,' were quite new to most of those present. A paper upon the 'Flora of New Jersey' was contributed by the Rev. L. H. Lighthipe of Woodbridge, N.J., the president of the New Jersey Assembly. On Wednesday afternoon a *conversazione* on 'How to use the Microscope' was held by Prof. F. C. Van Dyck of Rutgers College. Remarks upon the subject were also made by Prof. George Macloskie of Princeton, who also exhibited a most convenient apparatus for the dissection of flowers and insects. In the evening a most interesting lecture upon diatoms was given by Prof. Samuel Lockwood of Freehold, N.J., illustrated by means of the stereopticon. Professor Lockwood has made these interesting microscopical plants the study of his lifetime, and consequently spoke from his own personal observations. His lecture was enjoyed by all; and the fact that his audience could see before them objects which are only visible by means of the microscope, magnified many thousand times, — we might almost say millions, — added very much to its interest. Thursday was an entomological day. The excursion in the morning was conducted by the Rev. G. D. Hulst, and the afternoon was devoted to the examination of insects collected, and to remarks by the same gentleman upon the collection, preservation, and classification of entomological specimens. In the evening a lecture upon seaweeds was given by Isaaac Holden of Bridgeport, Conn. This, like the lecture on diatoms, was made doubly interesting by means of the stereopticon. Mr. Holden also exhibited a large number of beautifully mounted specimens collected by him in the vicinity of his home at Bridgeport. On Friday afternoon, after the examination of the plants collected in the morning, a very instructive lecture was given by Prof. T. O'C. Sloane of the *Scientific American*, and author of 'Home Experiments in Science,' on 'How to make Scientific Experiments with Simple Apparatus.' This was illustrated by actual experiments in physics, made with very simple and inexpensive apparatus. It was a surprise to every one that so much could be accomplished, and so many experiments performed, at so trifling a cost.

The Seaside Assembly adjourned at the close of this lecture, every one present feeling that a very profitable week had been spent. The attendance was not so large as expected, but those who were present felt fully repaid for their coming. A universal desire was expressed that the assembly be held again next summer, and the committee of arrangements were requested to do what they could to accomplish this result. Should this be done, it is hoped that a large number of the chapters will take an active interest in the assembly. Rev. L. H. Lighthipe, Woodbridge, N.J., is chairman of the committee of arrangements, and as such he will be most happy to receive any suggestions that may be offered.

SCIENTIFIC NEWS IN WASHINGTON.

The Library of the Geological Survey: Strong in its Special Fields. — Light and Tree-Growth: Influences of Site and Atmospheric Conditions.

The National Geological Survey Library.

ONE of the most important and practically useful adjuncts of the National Geological Survey is its excellent library. The collection was begun in 1881, almost simultaneously with the establishment of the survey; and in the seven years that have elapsed, about twenty-five thousand bound volumes and more than forty thousand pamphlets have been accumulated. The first important acquisition of the library was in the fall of 1882, when Mr. Darwin, the librarian, negotiated the purchase of the Robert Clarke geological library in Cincinnati. It comprised about two thousand volumes, consisting principally of the reports of State geological surveys. This was the nucleus of what has become the most complete collection of State, United States, and foreign official reports of geological surveys now in existence. There are probably between four thousand and five thousand volumes in this department of the library, including many reports that are rare, and sets that it would be very difficult to duplicate. Of course, even this part of the library is not complete; but it is more nearly so than any other similar collection, and additions are frequently being made to it. It is in constant use by members of the survey preparatory to field-work.

The division of official reports is arranged in the following order: in the first sections are the reports of State surveys classified geographically. This portion of the department comprises a larger number of books than either of the others; and its practical value to the National Survey, as evidenced by its constant use, can hardly be overestimated. The careful study of its volumes prevents the duplication by the National Survey of work already done, and available. It may be interesting to note, in passing, that the first geological report authorized by a State legislature in the United States was ordered by the legislature of North Carolina, and published as a 'memoir' in 1819. It is a thin volume, treating of other topics in addition to the brief and very vague chapters on the geology of the State.

A succeeding portion of this same division contains a very full collection of reports of early United States Government surveys, reconnaissances, etc. Most of these were made under the direction

of the war department, and are especially interesting for the pictures they preserve of the vast area between the Missouri River and the Pacific Ocean before it became accessible to any except military expeditions, specially equipped exploring parties, trappers, and missionaries. Adjoining this section are complete sets of the reports and publications of the several surveys that preceded the National Geological Survey, and from the combination of which it was organized, — the Hayden, Powell, King. Nothing needs to be said of the practical value of this collection. The work of all of these surveys is being embodied in the maps prepared under the direction of Major Powell, and a large portion of it is found available, and adaptable to the uniform system adopted by the National Survey. These comprise all the official geological reports; but they are supplemented by a very full collection of United States Government reports on miscellaneous subjects, principally the resources and industries of the United States and of detached portions of the country. The National Survey itself, or different members, including Major Powell and several of his chief assistants, have made valuable contributions, in the form of reports, monographs, or bulletins, to our knowledge, especially of the resources of the less-understood portions of the country; and some of the most important work now in progress under the direction of the Nationa Survey has to do directly with economic subjects.

Lastly, in the division of official reports, are those of foreign countries. Canada has an excellent geological survey, and its publications are very valuable. European reports are arranged geographically, beginning with those of Russia. France and Germany have no geological surveys, but their commissions to make geological maps of those countries have made important reports. The collection of foreign reports is large.

Second in importance to the division of official reports, is the excellent collection of the transactions and proceedings of geological societies, those of scientific societies, and bound files of scientific periodicals. These occupy a large space in the library, and are constantly put to practical use.

The library has been recently enriched by the purchase in Paris of six hundred and twenty-five volumes, a part of the private library of Desnoyers, a distinguished geologist and writer, and librarian of the Paris Museum of Natural History. Many of these books are presentation copies, containing the autographs of their authors. The books purchased comprised nearly all offered in the divisions of geology, coal, glaciers, artesian wells, volcanoes and earthquakes, the geology of individual countries, mineralogy, and paleontology. Many of these books are rare, and their acquisition greatly enriches the library. A carefully selected general reference-library completes our survey.

In the bibliographical department a card-catalogue of authors, embracing the entire library of books and pamphlets, and consisting of several hundred thousand separate entries, has been finished. In addition to this, there is now in process of preparation a bibliography of North American geology, — a work that will require several years to finish, — and also a bibliography of the official geological reports of the States and of the United States Government. The work upon the latter has been about one-third done.

Probably there is no department of the National Survey library more highly prized than that of maps. Of these there are about twenty thousand, arranged geographically in drawers which admit of their lying flat. None of these are maps made by the National Survey, but they have been gathered from every available source, and constitute the largest and best collection of maps in the United States. A complete catalogue has been prepared, and the larger part of the maps are mounted on linen.

The library is admirably housed. The room devoted to its use is well lighted and ventilated, and not only admits of a most advantageous arrangement of the books, but it also affords excellent facilities for the work of the librarian's assistants, and conveniences for those who have occasion to consult the books.

The Influence of Light upon Tree-Growth.

Among the interesting discussions to be found in Professor Fernow's second annual report on forestry is a brief consideration of the influence of light upon the development of various trees of the forest. The following extracts give the essential portions of it: —

"It is a well-known fact that light is necessary for the development of chlorophyl, and therefore for the life of all green plants, and especially for tree-life and wood-formation. Heat alone, which practically always accompanies light, is not sufficient for this purpose, although it is still an open question as to what the absolute light-requirement of a tree species may be, or how much of the effect of increased light on growth is attributable to the light alone, and how much to the accompanying heat. Yet it is undeniable that there exists a relative difference of light-requirement, not only for different species of trees, but for all other plants.

"In last year's report I alluded to this difference in regard to the forest-weeds, which serve in forest management as an indication of the amount of shade which the trees exert, and with that their capacity of impeding evaporation from the soil. While the rosin-weed, sunflowers, some of the golden-rods (*Solidago nemoralis*), and some of the meadow-grasses, and the fire-weed (*Erechthites hieracifolia*), may be mentioned as requiring full sunlight for their best development, the Indian pipe (*Monotropa*) is most decidedly averse to a high degree of light. The partridge-berry (*Mitchella repens*), and among the grasses *Poa flexuosa, brevifolia, Festuca nutans, Cinna arundinacea*, may be named as seeking the shade. The ground hemlock and rhododendron are also characteristic shade-plants. By careful observation we could make a classification of weeds characterized by their dependence for normal development on various degrees of light and shade.

"The frequently observed change or 'alteration' of the flora, when the original forest is removed, must to some extent be explained by this light-influence.

"The amount of light required is, however, considerably modified by other influences of site. Where the intensity of the sunlight is great, as in southern countries, in higher altitudes, and in dryer climates, and also where the growing season is longer or the number of sunny days greater, a shade-enduring species will be able to sustain still more shade, and a light-needing one may even become shade-enduring. The flora of high altitudes, therefore, is in general decidedly light-needing. The elms, oaks, and ashes, which in northern latitudes are clearly light-needing, may in southern latitudes endure considerable shade.

"Trees are no exception to this rule; and while nearly all develop best, i.e., make the most wood, in the full enjoyment of light, their capacity of preserving their vitality and of developing under the shade varies greatly. While the yew will thrive in the densest shade, a few years of overtopping will kill the larch; so, also, while the beech will grow with considerable energy under the partial shade of such trees as ash, maple, etc., the oak will only just keep alive under the same conditions, and some of the birches would die.

"Favorable moisture-conditions make all species less sensitive to the withdrawal of light; and here, perhaps, the influence of the heat which accompanies the sunlight plays an important part. Therefore, on the fresh soils of bottom-lands, on northern exposures, and in the coves and depressions in the mountains, the light-needing species will be found to suffer less from shading than on dry, poor soils. Even so shade-enduring a species as the spruce becomes sensitive to the withdrawal of light when growing on dryer mountain-sites.

"The observations by which we may arrive at a relative classification of our timber-trees with regard to their light-requirements must therefore be made with due consideration of these modifying influences. The capacity to withstand shade, even in later life (in their youth most trees will stand considerable shade), is noticeable in the denser or less dense foliage, and in the capacity of overtopped individuals or overshaded branches to preserve their vitality for a longer or shorter time. The observations on this line must, then, be made in the dense forests, in order to be able to judge of their characteristic foliage-development in the shade; for, if grown in the open, so much light is accessible to every part of the crown, that leaf-development, even in the interior of the crown, is unimpeded, and quite a dense foliage is the result. Thus, in the open, the maples, elms, sycamores, black locusts, etc., make good shade-trees, while in the dense forest they thin out and have but scanty foliage. The conifers, which, like the spruces and firs, preserve the foliage of several years, have perhaps the greatest capability of growing under shade, and preserving their foliage, in spite of the

withdrawal of light. But, in the present state of our knowledge, we become painfully aware that we are lacking sufficient data to group even our most important forest-trees in a series according to light-requirements. This is not so, however, in Europe. Some forty years ago German foresters made observations along this line, formulating them and elaborating rules for the management of the various species, especially in thinning, mixing, and cutting for reproduction; and, although these rules have been practised for so long a time based on empirical knowledge, it is only now that Dr. Kienitz offers a physiological explanation of the difference in the behavior of trees under changing light-conditions. He found that on the same branch those leaves which are developed under the full influence of the sunlight are not only, as was known before, often larger and always tougher in texture, and thicker, but they have a larger number of stomata (or 'breathing-pores'), than those formed under less exposure to sunlight. The same, of course, was observed in individual trees grown under shade and in full enjoyment of light. If, then, the trees which have their foliage formed under the shade of outgrowing neighbors are suddenly placed in different light-conditions, the foliage is not adapted to perform its function as energetically as the stronger light necessitates. The buds which are formed in deficient light, show also in their leaves a deficiency in the number of stomata; and in consequence the favorable influence upon wood-formation, due to increased light, for which the thinnings and interlucations are made, become in fact noticeable only the second year, when new buds, developed under the increased light-influence, have formed leaves adapted to the changed conditions. In conifers, which hold their leaves for several years, this adaptation naturally takes a much longer time; and under unfavorable conditions, if moved too suddenly from the shade into the light, they often lose their old foliage, and even die before the new foliage adapted to the light-influence is sufficiently developed to sustain the increased demand of respiration, transpiration, and assimilation.

"The importance of this knowledge becomes apparent when we attempt to formulate the rules for thinnings, etc. There is hardly any line of investigation, observation, and experiment more fruitful, and more needed for the practical purposes of forest planting and management, than to establish this relation of our timber-trees to light-conditions. The rational compositions and form of our plantations, their management and reproduction, are based upon this knowledge, and the proper application of it may be well termed 'the essence of forestry.'

"Observations and experiments, therefore, in regard to the dependence of our important timber-trees upon light-conditions, are among the first to be undertaken by the experiment-stations in the forest and in the nursery.

"Hand in hand with these experiments, will go, of course, the inquiries into the rate of growth and yield before alluded to. If there are old growths at hand, the influence upon the yield of thinning with consequent 'undergrowing' may be ascertained."

ETHNOLOGY.

The Prehistoric Race of Spain.

MESSRS. H. AND L. SIRET have published the results of their interesting archæological researches in south-eastern Spain, and from their finds trace the history of the primitive people inhabiting that country. The most ancient remains show this people living in the neolithic period; later on, copper and bronze were used. Thus the researches of the authors give interesting confirmation of the recently established fact, that a copper age preceded the bronze age in most parts of Europe. At the close of the bronze age, silver is first used, and fortified villages occur. At the same time the methods of manufacturing bronze are improved. No iron was found in any of the stations of this people. There were two modes of burial: the dead were buried in large clay vessels, or the corpses were burnt. Weapons, ornaments, tools, food, and earthenware are always found in the graves, of which about a hundred were explored. The latter have been studied by Jaques. The results of the latter are summarized by Kollmann as follows. First of all, the principal result is of great value: various races occurred among these early inhabitants. No history mentions the name of this people. Since the neolithic period it has remained in the same locality. The impression is, that its culture developed continuously without any breaks. Its origin and descent are unknown, but one fact is shown by the forms of the skulls: it was a European people, consisting of European types, the same as live at present in Europe, and which lived at a still earlier period in the caves of Estremadura and at the kitchen-middens of Mugem, or later on in the dolmens near Lisbon. A series of dolichocephalic skulls has been found with an average cranial index of 73.8, and long face. The nose is long and the orbit high. This is the exact counterpart of the long skull of the northern inhabitants of Europe. Besides these, Jaques found a short-headed race, also with long faces, high noses and orbits. Their type also occurs frequently in northern Europe. A third race is also brachycephalic, but its characteristics are a broad, flat face, and strong prognathism. Broca considers this type mongoloid. Nevertheless, from a study of the photographs contained in the work, we assume that this race also is of exactly the same type as the European broad-faced, short-headed races, and does not resemble the Mongols. Besides this, a race with broad faces and long heads, the Cro-Magnon race of French writers was found. The fundamental conclusion from these facts is, that in this early period the shores of the Mediterranean were inhabited by several European races. Kollmann considers this result a confirmation of his theory that the migrating European tribes spread early over the whole continent, and that all European peoples consist of a mixture of these earliest inhabitants.

THE EVOLUTION OF ORNAMENTS. — There are few branches of ethnology in which the usefulness of extensive collections becomes more evident than in the study of the development of ornament. It is only in collections of this kind that incidental ornaments can be distinguished from characteristic ones. Since Holmes's admirable study of American ornaments, a number of essays have been published, most of which refer to the islands of the Pacific Ocean. Some time ago we mentioned Dr. L. Serrurier's study of arrows from New Guinea, which was published in the *International Ethnographical Archive*. The May number of the *Journal of the Anthropological Institute* contains another paper on a similar subject. Mr. Henry Balfour has studied a collection of arrows from the Solomon Islands, which are on exhibition in the Pitt Rivers Museum at Oxford. The ornamental design of these arrows is invariably found immediately above the joints of the reed of which the shaft is made. It usually consists of a number of incised straight lines, blackened, and running parallel to the shaft, so as to form a band round it. Balfour shows that this design originated in the necessary smoothing-off of the joints. When this is done, the fibrous nature of the substance of the reed causes narrow strips to peel away along the length of the shaft. To prevent this peeling extending far, cross-notches were cut. This was the origin of the ornament, which was later on retained, even when other methods of smoothing off the joints were used. Balfour compares this ornament with those of reed arrows from other countries, and shows that it is probably confined to the Solomon Islands, other methods of ornamentation and of smoothing the joint being used by other peoples. He mentions only a single arrow from South America of a similar description.

HEALTH MATTERS.

Diagnosis of Human Blood.

THE diagnosis of human blood is discussed by Dr. Henry Formad in the *Journal of Comparative Medicine*. Especial attention is given to the methods of examining blood-stains and measuring the blood-corpuscles.

For testing the question whether a certain substance is blood or not, the spectroscope and chemical re-agents come into play; but for the recognition of human blood the microscope alone is of any value, and the sole method yet found available with this instrument is that of measurement of the corpuscular elements. The differentiation of mammalian blood from that of lower orders of animals is made easy by the fact that in mammals alone is the cell round and non-nucleated. The differentiation between the blood of man and that of lower mammals depends entirely upon the micrometer.

Only the following animals have corpuscles larger than man, i.e., larger than $\frac{1}{3200}$ of an inch; viz., the elephant, great ant-eater, walrus, sloth, platypus, whale, capibara, and (according to Wormley) opossum. Animals the corpuscles of which are slightly below man in size, i.e., having corpuscles from $\frac{1}{3500}$ to $\frac{1}{3200}$ of an inch average diameter, are the seal, beaver, musk-rat, porcupine, monkey, kangaroo, wolf, and guinea-pig. None of these are domestic animals. All other animals, including all domestic animals, have blood-corpuscles of a mean diameter less than $\frac{1}{3500}$ of an inch; and, in fact, those animals which, as a rule, are blamed for blood-stains found on the clothing and apparel of criminals (ox, pig, horse, sheep, and goat), have corpuscles with an average diameter less than $\frac{1}{4000}$ of an inch. He summarizes the facts as follows: —

1. The blood-corpuscles of birds, fishes, and reptiles, being oval and nucleated, can never be mistaken for human blood.

2. Fresh human blood cannot be mistaken, under the microscope, for the blood of any animal the corpuscles of which have a mean diameter of less than $\frac{1}{4000}$, or even $\frac{1}{3600}$, of an inch.

3. (*a*) If the average diameter of blood-corpuscles in fresh blood is less than $\frac{1}{4000}$, then it cannot possibly be human blood; (*b*) if the diameter is more than $\frac{1}{3500}$, then it may be human blood; (*c*) if the blood-corpuscles, after exhaustive measurement, give a mean diameter of more than $\frac{1}{3300}$, then it *is* human blood (provided it is not the blood of one of the wild beasts referred to).

The foregoing applies especially to the diagnosis of fresh blood. With regard to dried blood, it is claimed that this can be recognized just as readily, provided it has dried quickly. Blood that has dried slowly undergoes decomposition, and its morphology cannot be made out. A good liquid for remoistening blood is Müller's fluid; but perhaps the best is Virchow's solution, composed of thirty parts caustic potash and seventy parts water. At least five hundred measurements should be made in order to establish the average diameter of the cells.

If the corpuscles are spheroidal from absorption of moisture, or crenated from drying, they may still be diagnosed, because such changes are the same in the corpuscles of all animals, and have really their proportionate and corresponding ratio of alteration in form and diminution in size, the range or scale of diminution being always alike in the same animal.

The red blood-corpuscles that have become spherical from imbibition of liquid have thus presented in Dr. Formad's experiments the following average diameters in the various animals: 1. Man, $\frac{1}{4300}$ inch; 2. guinea-pig, $\frac{1}{4500}$ inch; 3. Wolf, $\frac{1}{4600}$ inch; 4. Dog, $\frac{1}{4800}$ inch; 5. Rabbit, $\frac{1}{4900}$ inch; 6. Ox, $\frac{1}{5600}$ inch; 7. Sheep, $\frac{1}{6700}$ inch; 8. Goat, $\frac{1}{8100}$ inch.

These figures show that the diameter of the artificially spherical corpuscles in each animal is just about one-third less than that of the normal bi-concave or disk-like corpuscles of the same animals.

The question has long been a mooted one, as to whether the microscope can be depended on to determine positively, or not, that a given specimen of blood is that of a human being. Dr. Formad believes that this can be done, while other microscopists of equal eminence deny the possibility.

VACCINATION. — That small-pox has greatly declined in England during the past fifty years is apparent from figures which have been published by Dr. Henry Thorne. From 1838 to 1842 the deaths from small-pox in England amounted to 57.2 per 100,000; in 1880–84 the death-rate was 6.5 per 100,000. He thinks that vaccination has not only a direct influence in causing this reduction in the number of victims to small-pox, but that it has also a tendency to decrease the liability to the disease of children of vaccinated parents. In this connection it is interesting to note that *The Medical Press* states, that, out of the five thousand children born every month in Paris, only a thousand are vaccinated by the medical officers appointed for that purpose. The remaining four thousand infants are therefore either vaccinated by private practitioners, or not at all. Seeing, however, that more than half the population apply for and receive gratuitous medical attendance, and that half the burials are gratuitous, it is very unlikely that all of the four thousand are vaccinated at the cost of the parents. It may fairly be assumed that a large proportion are not vaccinated at all, and that is why small-pox exists as an endemic disease at Paris, and does not disappear, as it has done, to a great extent, in Germany.

ELECTRICAL SCIENCE.

Experiments in Proof of the Electro-magnetic Theory of Light.

IN his presidential address before the mathematical and physical section of the British Association, Prof. G. F. Fitzgerald dwelt at length on the recent experiments of Hertz in Germany on the propagation of electro-magnetic disturbances. These experiments are of so much importance, and go so far toward confirming the electro-magnetic theory of light, that a brief *résumé* of the subject will not be untimely.

There have been for years two theories with respect to the action upon each other of quantities of electricity, and of elements of electric current. One held that the various phenomena were caused by direct action at a distance; the other, that they were due to the action of the intervening medium. With respect to the electrostatic phenomena, Faraday's discovery that the capacity of a condenser varied with different dielectrics between the conducting coatings, made the theory of direct action extremely improbable; and his work, with that of Maxwell, has put the theory of an action of the dielectric on a firm foundation.

With respect to electro-magnetic phenomena, however, the case is different. Maxwell, in his magnificent work on electricity and magnetism, developed the idea that electro-magnetic actions are dependent on the surrounding medium, and one of the results is the electro-magnetic theory of light. But there has been no direct and unquestioned proof that there really is such an action in the dielectric as Maxwell has supposed. To illustrate the fundamental ideas involved, suppose we have a condenser made of two sheets of tinfoil with glass between; and suppose, further, that we have a battery whose poles may be connected to the coatings of the condenser. If we suddenly connect the poles to the coatings, there will be a momentary current, which will last only long enough to charge the condenser, probably for only a small fraction of a second. Now, the general idea was, that there was a current in the battery, and in the wires used to connect it with the condenser; and the result was to charge the two coatings, one with plus, the other with minus, electricity; and there the action stopped. Maxwell's idea was, that the current, so long as it lasted, was perfectly continuous, but that in the glass plate the action consisted of a 'displacement' of electricity; that is, considering a number of planes drawn through the conductors and through the glass, perpendicular to the direction of current, the amount of electricity crossing any plane was the same at the same instant, but that in the glass the result was a state of strain, exactly as if a spring were bent. The amount of 'displacement' depends on the displacing force, — the electro-motive force of the battery. When the proper displacement has taken place, all further action ceases, unless the strain is too great, in which case the dielectric breaks down, and we have the well-known phenomenon of disruptive discharge. The amount of displacement determines the charge of the condenser. When the electro-motive force is removed and the coatings joined, the strain in the dielectric relieves itself, producing the discharge.

If we charge the condenser with an alternating current, we have in the glass continuous displacement currents, first in one direction, then in the other.

From this fundamental idea of looking to the dielectric for the really important part of the phenomena, Maxwell was led to consider the laws by which the vibration of electricity on a small conductor would be propagated in the surrounding medium. He found that the equations governing the propagation were essentially the same as those deduced from the elastic solid theory of light; and he found that the velocity of propagation of such a disturbance was equal to a certain electrical constant which has several times been determined, and which agrees, within the limit of experimental error, with the value of the velocity of light. He also showed a relation between the specific inductive capacity and index of refraction of substances, which has not been completely proved, but which is suggestively close.

Here the matter dropped for a while. The theory has been extended, notably by Rowland and Fitzgerald, to account for other phenomena of light, but no experimental evidence of a conclusive nature has been produced.

It had not been shown, until Hertz's experiments were made, that the vibration of an electric current would set up disturbances in the surrounding medium, — the assumption on which Maxwell's theory was based. Hertz proved this in the following way: conducting circuits have definite time-constants, just as stretched strings have definite periods of vibration; and a disturbance whose period is the same as the time-constant of the circuit will produce a greater effect than any other, just as a piano-string will vibrate if one sings the note to which it corresponds. Hertz produced electric vibrations of a short and definite period, — one hundred millionth of a second, of a wave-length of about two metres, — and studied the effect on a receiving-circuit of the same time-constant. The receiving-circuit had a short air-space in it, and sparks were observed leaping across this space. By placing the vibrator several wave-lengths from a reflector, and moving the receiver between the two, he observed that at certain distances the induced sparks were faint; then, on moving the circuit, they became brighter, then disappeared again, — phenomena exactly resembling Lloyd's bands in optics, due to interference. To quote Professor Fitzgerald, "Henceforth I hope no learner will fail to be impressed with the theory — hypothesis no longer — that electro-magnetic actions are due to a medium pervading all known space, and that it is the same medium as the one by which light is propagated; that non-conductors can, and probably do, as Professor Poynting has taught us, transmit electro-magnetic energy. By means of variable currents, energy is propagated into space with the velocity of light."

The experiments of Hertz have made Maxwell's theory of light more than possibly true, and it seems as though light must be hereafter considered as an electro-magnetic phenomenon.

A NEW SYSTEM OF ELECTRICAL DISTRIBUTION BY STORAGE-BATTERIES. — Mr. Henry Edmunds has brought out a new system of distribution by storage-batteries, that seems to have a good deal of merit. The systems that have been used have objections which Mr. Edmunds obviates. Mr. Crompton's plan for using batteries is to have a number of groups in series on the main line, taking the current for distribution from the ends of each group. The batteries are connected with the charging and discharging circuits at the same time. The obvious disadvantage of this plan is that a high potential cannot be used, since the lamp-circuit is liable to have its potential raised to the maximum of the charging circuit; and, with more than four hundred volts difference of potential at the dynamo terminals, this would be distinctly unsafe. The other system consists in having two sets of cells, one of which is being charged while the other is discharging. Mr. Edmunds's is a modification of the latter plan. If he wishes forty-eight volts in the lamp-circuits, he uses thirty-two cells, divided into four sets of eight cells each. Three sets in series are constantly connected with the lamp-circuit, while the fourth set is being charged. A device is provided by which the various sets are put in rotation in the charging and discharging circuits, remaining two minutes in the former, six in the latter. In changing from one circuit to the other, a resistance is put in place of the battery being charged, so the main circuit is never broken. By putting two sets in parallel for an instant, a break in the lamp-circuit is avoided. This plan has the advantage of allowing high electro-motive forces to be used without necessitating a double outfit of batteries; and the efficiency should be greater than when the cells are charged for a considerable period and then discharged.

BOOK-REVIEWS.

The Aryan Race. By CHARLES MORRIS. Chicago, Griggs. 12°. $1.50.

THE present volume is a concise and pleasantly written review of the results of recent investigations on the home and history of the Aryan race. It is intended to be a popular book; and its object — to make clear to the general reader these interesting questions and their solutions, so far as reached to-day — has been well accomplished. The author is careful to give the evidence favoring the various theories as to the origin of the Aryans; and, although he states as his own view that they probably originated in south-eastern Europe, he does not urge his opinion upon the reader, but allows him to draw his own conclusions from the evidence offered. In an introductory chapter the author discusses the division of mankind into races, and claims that the Caucasians are a branch of the Mongols. He even goes so far as to divide mankind into two races, — the Mongoloid and Negroid. Anthropologists will hardly concur with the author's views expressed in this chapter. He next sets forth very candidly the arguments advanced by various writers as to the early home of the Aryans, and continues to trace their migrations as compared to those of other races. From linguistic evidence he describes their early stage of culture, their ancestral and nature worship, and their political development. When the author, in the chapter on the development of language, turns to consider languages other than Aryan, he is somewhat too sweeping in his statements regarding them, and we find throughout the book that the author's desire to eulogize the Aryan race has led him to underestimate the merits of the rest of mankind. The history of the Aryans is followed in general outlines up to the present time; and the book concludes with a glowing prospect of the future, the author assuming that even the fastnesses of Central Africa will become the home of the conquerors of the world.

On the Study of Words. By R. C. TRENCH. New York, Macmillan. 16°. $1.

THIS is the twentieth edition of Archbishop Trench's charming book, revised by A. L. Mayhew. The editor has not made any change in the arrangement of the book, but he has purged it of all erroneous etymologies, and corrected in the text small matters of detail, according to the recent advances of the science of philology. He has done well in altering as little as possible of the author's work, for it would be hardly possible to increase the attractiveness of Trench's style, and of his method of treating his subject. He has set forth the charms of the study of etymologies in a way that can hardly be improved, and that will make every reader a friend of this science. It will also induce the reader to a thoughtful use of words; to considering their "poetry and morality," to use the author's words. It is hardly necessary to recommend the interesting little volume, for the fact that it was necessary to publish a twentieth edition is sufficient proof of its great merits.

The Essentials of Geography. By G. C. FISHER. Boston, N. E. Publ. Co. 8°.

THIS is one of the old-style geographies, which are of no educational value, and only adapted for rote work. It is the briefest possible compilation of geographical facts, arranged without any geographical or educational method. The statements are extremely meagre, and the author has not been sufficiently critical in selecting them to make his book an 'authority,' as he expresses himself in the preface. The book is accompanied by sketch-maps, by the use of which the author hopes to enliven the teaching of geography; which, however, are also only useful for a teacher who is satisfied with routine work, and with cramming the minds of his pupils with facts.

How the Peasant Owner Lives. By LADY VERNEY. London and New York, Macmillan. 12°. $1.

LADY VERNEY has collected some descriptions of the life of peasant-owners in France, Germany, Italy, and Russia, with the object of defending the large English and more particularly Irish estates. She dwells on the fact that small estates cannot be worked economically, especially where they consist of small detached sections. She shows more particularly the evil results of this system in France. The authoress sees the only remedy against these effects in the consolidation of these small estates in the hands of great land-owners and the abolishment of small farms. Her ideal is that the small farmer should not try to make his living out of the produce of his little patch of land, but that he should become a laborer on a large estate. She deems the attempts to consolidate farms, that have been made on the European continent, unimportant, and also hardly touches the state of the workingman-peasants, who earn money as workers in factories, but at the same time own small patches of land on which they raise some of the necessaries of life. From this point of view, she condemns the efforts to create a peasantry in Ireland, and concludes her book with a touching romance, 'A Yeoman's Home in the Dales Sixty Years since.'

Citizen's Atlas of American Politics, 1789–1888. By FLETCHER W. HEWES. New York, Scribner. f°. $2.

THIS atlas is a campaign publication of peculiar interest, as it gives a clear graphical insight into some of the questions at issue. A number of maps show the comparative condition of the tariff, and the wages of skilled and unskilled labor for any corresponding period during the past forty years. Wages and cost of living are compared, and import and export charts show the country's part in the trade of the world. A large map is devoted to the production of wool and the value of the total product of manufactures. The latter maps are compiled from the returns of the Tenth Census, and are very interesting. The distribution of the foreign-born population receives special attention, one large map showing its ratio to the total population, while four smaller maps show that of the Germans, Irish, English, and Welsh, and of British Americans. These charts have been taken from 'Scribner's Statistical Atlas of the United States.' The first charts of the atlas represent the political history of the country, giving at a single glance a view of the supremacy of parties and of the increase of the popular vote. Another series of maps shows the history of presidential elections. The atlas is of special interest at present, containing, as it does, valuable and accurate information on some of the most important questions to be decided by the imminent election.

PUBLISHERS' FALL ANNOUNCEMENTS.

Houghton, Mifflin, & Co.

IN the American Commonwealths Series, 'Indiana: a Redemption from Slavery,' by J. P. Dunn, jun.; and 'Ohio: Historical Sketches of the First Fruits of the Ordinance of 1787,' by Rufus King. Under the title 'American Religious Leaders,' — a series of biographies of men who have exerted great influence on the religious thought and life of America, — the following will be among the earlier issues: 'Jonathan Edwards,' by Prof. A. V. G. Allen; 'Charles Hodge,' by Pres. Francis L. Patton of Princeton; 'Francis Wayland,' by Prof. J. O. Murray of Princeton; 'Wilbur Fisk,' by Prof. George Prentice of Wesleyan University; 'Archbishop John Hughes,' by John G. Shea, LL.D.; and 'Theodore Parker,' by John Fiske. 'A Latin Grammar,' by E. A. Andrews and S. Stoddard (new edition, thoroughly revised by Henry Preble). 'Colonial Times on Buzzard's Bay,' by W. R. Bliss. 'The Critical Period of American History, 1783–89,' by John Fiske. 'The Chief Contents of the *Gentleman's Magazine*, from 1731 to 1868,' edited by G. Laurence Gomme, F.S.A. (in fourteen volumes): Vol. IX. 'Literary Curiosities;' Vol. X. 'Topography.' 'Essay on Language, and Other Papers,' by Rowland G. Hazard (new edition). 'Freedom of Mind in Willing; or, Every Being that wills a Creative First Cause,' by Rowland G. Hazard (new edition). 'Two Letters on Causation and Freedom in Willing,' addressed to John Stuart Mill, with other papers, by Rowland G. Hazard (new edition). 'Realistic Idealism in Philosophy Itself,' by Nathaniel Holmes (in two volumes, crown 8°, $5). 'Young Sir Henry Vane,' by James K. Hosmer. 'Ancient Rome in the Light of Recent Discoveries,' by Rodolfo Lanciani, with two maps and about 100 illustrations. 'The Soul of the Far East,' by Percival Lowell. 'The Law of Eqivalents, in its Relations to Political and Social Ethics,' by Edward Payson. 'Index to Periodical Literature' (first supplement, Jan. 1, 1882, to Jan. 1, 1887), by William Frederick Poole and William I. Fletcher, with the co-operation of the American Library Association. 'Books and Men,' by Agnes Repplier. 'The Riverside Natural History,' by a corps of forty-three writers, with full bibliography, over 2,200 woodcuts in the text, 168 full-page engravings, and 12 colored plates; in six volumes; sold only by subscription. 'Second Lessons in Arithmetic,' designed to follow Colburn's 'First Lessons,' by H. N. Wheeler. In preparation: 'Narrative and Critical History of America,' edited by Justin Winsor: Vol. I. 'America before Columbus;' Vol. VIII. 'The Later History of British and Spanish America.'

Lee & Shepard.

'Mexico — Picturesque, Political, Progressive,' by Mary E. Blake and Margaret E. Sullivan; 'Physical Development, or the Laws governing the Human System,' by Nathan Allen, M.D.; 'A Physician's Problems,' by Charles Elam; 'The Story of Evolution, the Development Theory,' by Joseph Y. and Fanny Bergen; 'Methods and Aids in Geography Teaching,' by Charles F. King; 'Primary Methods in Zoölogy Teaching for Teachers in Common Schools,' by Dr. W. P. Manton; 'Chips from Educational Workshops in Europe,' and 'Chips from a Teacher's Workshop, Educational Topics of the Day,' by L. R. Klemm.

J. B. Lippincott Company.

'A Popular History of Music, Musical Instruments, Ballet, and Opera, from St. Ambrose to Mozart,' by James E. Matthew. 'Highways and Horses,' by Athol Maudsley (fully illustrated). In the International Statesman Series, 'Lord Beaconsfield,' by T. E. Kebbel; 'Viscount Palmerston,' by Lloyd C. Sanders; and 'O'Connell,' by J. A. Hamilton. The following volumes are in a state of active preparation, and the date of their appearance will be duly announced: 'Prince Metternich,' by Col. G. B. Malleson, C.S.I.; 'Peel,' by F. C. Montague, fellow of Oriel College, Oxford; 'Lord Bolingbroke,' 'William Pitt,' 'Charles James Fox,' 'The Marquis Wellesley,' 'The Prince Consort,' 'Lord Dalhousie,' 'Earl Russell,' 'Lord Derby,' 'Prince Gortschakoff,' 'Gambetta,' and others. 'The Life of the Right Hon. W. E. Forster,' by T. Wemyss Reid, with portraits and other illustrations. 'Life of Henry M. Stanley,' by Rev. H. W. Little. 'Animal Life of the Sea-Shore,' by Angelo Heilprin. 'With the Camel Corps up the Nile,' by Count Gleichen. 'Practical Microscopy,' by George E. Davis (a new edition). 'An Elementary Treatise on Human Anatomy,' by Joseph Leidy. 'A Cyclopædia of Diseases of Children, and their Treatment, Medical and Surgical,' edited by J. M. Keating, M.D. 'Intracranial Tumors,' by Byron Bramwell, M.D. 'The Chemical Analysis of Iron,' by Andrew Alexander Blair. 'Young Folks' Science in Story,' containing young folks' whys and wherefores, young folks' ideas, and young folks' queries (new edition). 'Animals and Birds, their Homes and their Habits,' a book for young people, by Uncle Warren (new edition). 'Half-Hours with American History,' selected and arranged by Charles Morris.

Macmillan & Co.

'Natural Inheritance,' by Francis Galton, with illustrations and diagrams; 'Electricity and Magnetism, a Popular Treatise,' by Amedee Guillemin, translated and edited, with additions and notes, by Prof. Silvanus P. Thompson, with numerous illustrations; 'A Practical Text-Book of Pathology,' by D. J. Hamilton; 'Popular Lectures and Addresses on Various Subjects in Physical Science,' by Sir William Thomson, D.C.L., with illustrations; 'Scientific Papers by the Late Professor Andrews,' edited by Prof. P. G. Tait, M.A., and Prof. Crum Brown, F.R.S.; 'Alphabet of Economic Science,' by Philip H. Wicksteed, M.A.; 'A Text-Book of Physiology,' by Michael Foster, M.D., F.R.S., with illustrations, a new and thoroughly revised edition, in three parts, 8°. (Part I. immediately); 'Absolute Measurements in Electricity and Magnetism,' by Andrew Gray, M.A., second edition, in two volumes (Vol. I. immediately); 'Examples in Physics,' by D. E. Jones; 'A Text-Book of Practical Metallurgy and Assaying,' by Arthur H. Hiorns, with illustrations; 'A Text-Book on Elementary Theoretical Metallurgy,' by A. H. Hiorns, with illustrations; 'Experimental Mechanics, a Course of Lectures delivered at the Royal College of Science for Ireland,' by Sir R. S. Ball, M.A., new edition; 'Questions and Examples in Experimental Physics,' by B. Loewy; 'Statics for Schools,' by John Greaves, M.A.; 'Geometrical Conics, an Elementary Treatise, drawn up in Accordance with the Syllabus issued by the Society for the Improvement of Geometrical Teaching,' by A. Cockshott, M.A.; 'Elementary Synthetic Geometry of the Point, Line and Circle in the Plane,' by N. F. Dupuis, M.A., F.R.S.C.; 'Examples for Practice in the Use of Seven-Figure Logarithms,' by Joseph Wolstenholme, D.Sc., new edition, greatly enlarged; 'Practical Logarithms and Trigonometry,' by J. H. Palmer; 'A Treatise on Trigonometry,' by W. E. Johnson; 'The History of Mathematics,' by W. W. Rouse Ball; 'Elementary Statics,' by the Rev. J. B. Lock, M.A.; 'Photographic Chemistry,' by Raphael Meldola, F.R.S. (Nature Series); 'A Key to Mr. Lock's "Arithmetic for Schools,"' by the Rev. R. G. Watson, M.A.; 'A Key to Mr. Lock's "Elementary Trigonometry,"' by Henry Carr;

'A Key to Mr. Charles Smith's "Conic Sections,"' by Charles Smith, M.A.; 'Macmillan's Geographical Series,' edited by Archibald Geikie, F.R.S.; 'Maps and Map-Making,' by Alfred Hughes, M.A.; 'An Elementary General Geography,' by Hugh Robert Mill, D.Sc.; and 'A Geography of Europe,' by James Sime, M.A.

G. P. Putnam's Sons.

'American Literature, 1607–1885,' Part II. (completing the work) 'American Poetry and Fiction,' by Charles F. Richardson; a second impression of Part I. 'The Development of American Thought.' 'Popular Tales from the Norse,' by Sir George Webbe Dasent, D.C.L., etc., with an introductory essay on the origin and diffusion of popular tales (third edition). 'The Best Books: A Reader's Guide to the Choice of the Best Available Books in all Departments of Literature down to 1887,' rewritten and much enlarged, compiled by William Swan Sonnenschein. 'A History of Greece,' by Evelyn Abbott, M.A., LL.D., fellow of Balliol College, Oxford (to be complete in three parts). 'Omitted Chapters of History disclosed in the Life and Papers of Edmund Randolph,' by Moncure D. Conway. 'Governor Chamberlain's Administration in South Carolina,' a chapter of reconstruction in the Southern States, by Walter Allen. 'American Orations,' edited by Alexander Johnston. 'The Life and Letters of Dr. S. Wells Williams,' author of 'The Middle Kingdom,' and many years missionary in China, by Frederick Wells Williams. 'Some Chapters on Judaism and the Science of Religion,' by Rabbi Louis Grossman. 'Emanuel Swedenborg,' an essay, by John Bigelow. 'Proverbs and Phrases of All Ages,' by Robert Christy. 'A Sketch of the Germanic Constitution, from the Early Times to the Dissolution of the Empire,' by Samuel Epes Turner. In the Series of the Great Cities of the Republic, II. 'The Story of Boston,' by Arthur Gilman. In the Story of the Nations Series, XIX. 'The Story of Turkey,' by Stanley Lane-Poole, assisted by E. J. W. Gibb and Arthur Gilman; XX. 'The Story of Media, Babylon, and Persia, including a Study of the Zend-avesta or Religion of Zoroaster, from the Fall of Nineveh to the Persian War,' a continuation of 'The Story of Assyria,' by Z. A. Ragozin; XXI. 'The Story of Mediæval France, from the Reign of Hugues Capet to the Beginning of the Sixteenth Century,' by Gustave Masson; 'The Story of Holland,' by James E. Thorold Rogers; 'The Story of Mexico,' by Susan Hale; 'The Story of Phœnicia,' by Prof. George Rawlinson. 'The Economic Interpretation of History,' being the substance of lectures delivered in Worcester College Hall, Oxford University (1887–88), by James E. Thorold Rogers. 'An Introduction to English Economic History and Theory,' by W. J. Ashley. 'Industrial Liberty, an Analysis of the Existing Conditions in the United States, with Special Reference to the Relations to the Public of Railways and Trusts,' by John Bonham. 'The Centennial of a Revolution,' an address by A Revolutionist. 'In Castle and Cabin, Talks in Ireland in 1887,' by George Pellew. 'Business,' by James Platt, F.S.S. (authorized American edition, reprinted from the seventy-fifth English edition). In the Questions of the Day Series, XLIV. 'The Present Condition of Economic Science, and the Demand for a Radical Change in its Methods and Aims,' by Edward C. Lunt; XLVII. 'The Tariff History of the United States, 1789–1888,' by Prof. F. W. Taussig; XLVIII. 'The President's Message,' with annotations of facts and figures, by R. R. Bowker; XLIX. 'Essays on Practical Politics,' by Theodore Roosevelt; L. 'Friendly Letters to American Farmers and Others,' by J. S. Moore. 'Suggestive Therapeutics, a Study of the Nature and Use of Hypnotism,' by Prof. H. Bernheim, translated by Dr. Christian A. Herter. 'The Insane in Foreign Countries, Notes of an Examination of European Methods of Caring for the Insane,' by the Hon. William P. Letchworth. In the German Classics for American Students, 'Selections from the Prose Works of Lessing,' edited by Horatio S. White.

Roberts Brothers.

'Harvard Vespers'—addresses to Harvard students by the preachers to the university—contains addresses by Francis G. Peabody, Phillips Brooks, Edward Everett Hale, Alexander McKenzie, George A. Gordon, and Andrew P. Peabody. 'The Book of Christmas,' descriptive of the customs, ceremonies, traditions, superstitions, fun, feeling, and festivities of the Christmas season, by Thomas K. Hervey, with all the original illustrations by R. Seymour. 'Franklin in France,' Part II. 'The Treaty of Peace and Franklin's Life till his Return,' from original documents, by Edward Everett Hale and Edward E. Hale, jun. 'The Study of Politics,' by Prof. W. P. Atkinson. 'New England Legends and Folklore, in Prose and Poetry,' with 100 effective character illustrations, from designs by Merrill and others (a new and cheaper edition). 'London of To-day, 1888,' by Charles E. Pascoe (fourth year of publication). 'The United States of Yesterday and of To-morrow,' by William Barrows, D.D. 'History of the People of Israel till the Time of King David,' by Ernest Renan, author of 'Life of Jesus.'

George Routledge & Sons.

'My Trip round the World,' by W. S. Caine, M.P. 'A Thousand Miles up the Nile,' by Miss Amelia B. Edwards (new edition). 'The Chess-Player's Manual,' by G. H. D. Gossip, with an American appendix by S. Lipschütz. 'The Handy Reference Atlas of the World,' by John Bartholomew, with 100 maps and plans, full geographical statistics, and a complete index. The sixty-three volumes forming Morley's Universal Library will be re-issued in twenty-one monthly volumes, grouped and arranged in historical order. The first of the series will be 'The Iliad of Homer, The Plays of Æschylus, The Plays of Sophocles;' 'The Plays of Euripides;' 'The Acharnians, The Knights and the Birds of Aristophanes, Treatise on Government by Aristotle, The Æneid of Virgil;' 'Fables and Proverbs from the Sanskrit (the Hitopadesa), Mediæval Tales, The Chronicle of the Cid;' 'The Imitation of Christ by Thomas à Kempis, Life of Cardinal Wolsey by Cavendish, Ideal Commonwealths.' The first volume of the Carisbrooke Library—a development of Morley's Universal Library (completed with its sixty-third volume), upon the same plan and under the same editorship as that series—will appear in October, 1888; subsequent ones, every other month. 'Schiller's Complete Works,' translated by Lord Lytton, Samuel T. Coleridge, and others; edited by Prof. Henry Morley. 'The Prime Ministers of Queen Victoria: including Sketches of Lord Melbourne, Sir Robert Peel, Earl of Derby, Lord Aberdeen, Lord Palmerston, Lord Beaconsfield, Mr. Gladstone, and the Marquis of Salisbury,' by George B. Smith. 'Lemprière's Classical Dictionary: containing a Copious Account of all the Proper Names mentioned in Ancient Authors, with the Value of Coins, Weights, and Measures used among the Greeks and Romans, and a Chronological Table' (new edition). 'About Robins: Songs, Facts, and Legends,' by Lady Lindsay. 'Warrior Kings from Charlemagne to Frederick the Great,' by Lady Lamb (new edition). 'Harry Treverton: a tale of Australian Life,' edited by Lady Broome. 'The Hunting of the "Hydra;" or, The Phantom Prahu,' a tale of adventure in Southern Africa, by Henry Frith.

Ticknor & Co.

'The Letters of Felix Mendelssohn to Ignaz and Charlotte Moscheles,' translated and edited by Felix Moscheles; 'Four Years with the Army of the Potomac,' by Regis De Trobriand, brevet major-general, U. S. Vols., translated by George K. Dauchy, with maps, and a steel portrait of General De Trobriand; 'The Other Side of War, with the Army of the Potomac, Letters from Headquarters of the United States Sanitary Commission during the Virginia Campaign of 1862,' by Catharine Prescott Wormeley; 'A Short History of the Secession War,' by Rossiter Johnson, author of 'The History of the War of 1812–15,' etc., with maps and plans; 'Pen and Powder,' by Franc B. Wilkie of the *Chicago Times*; 'Western China,' a Journey to the Great Buddhist Centre of Mount Omei,' by the Rev. Virgil C. Hart, B.D., fellow of the Royal Asiatic Society, with map and 12 full-page illustrations; 'Safe Building,' by Louis de Coppet Berg, Vol. I., illustrated; 'Ancient and Modern Light-Houses,' by Major D. P. Heap, fully illustrated.

Miscellaneous.

'The Life of Lord Stratford de Redcliffe,' by Mr. Stanley Lane-Poole, will shortly be published by Longmans, Green, & Co. (New York). It will give an inside view of that eternal Eastern question for which every English diplomatist must find an answer, as to the riddle of the Sphinx. Much of the matter in these volumes is autobiographical, and there are boyish recollections of

Sheridan, Byron, Fox, Pitt, Gustavus Adolphus, Wellington, and George Canning. At twenty-six our future Lord Stratford helped to found the *Quarterly Review*, and introduced Gifford to Murray. —— Messrs. Fords, Howard, & Hulbert (New York) announce for publication 'The Democratic Party: its History and Influence' (new third edition, revised to date); and 'Tenants of an Old Farm,' an illustrated work on insect-life, by Dr. Henry C. McCook, hitherto sold at $2.50, sold this season at $1.50. —— William R. Jenkins (New York) announces 'Paul Bercy's Works,' for the study of French by the natural method; 'La Langue Française;' 'La Langue Française' (seconde partie); 'Livre des Enfants,' *pour l'étude du Français*, a primer full of illustrations, which serve as object-lessons for the youngest children; 'Le Second Livre des Enfants' (just published), intended for children also. It is full of illustrations, and, like the first book, these form the basis upon which the text is arranged, rendering it attractive in every way to children who have mastered the first book. —— The Burrows Brothers Company (Cleveland, O.) announces 'Christian Science, its Truths and Errors,' by the Rev. H. Melville Tenney; and 'The Pocket Gem Pronouncing Dictionary,' by Lilla M. Tenney, on a new plan. —— The Century Company announces 'Ranch Life and the Hunting-Trail,' by Theodore Roosevelt. —— 'Principles of the Economic Philosophy of Society, Government and Industry,' by Van Buren Denslow, LL.D., has just been published by Cassell & Co. This firm continues its 'National Library,' edited by Prof. Henry Morley, LL.D., a series of weekly volumes of reprints of standard works.

NOTES AND NEWS.

THE New York Academy of Science held its opening meeting Oct. 1. By the election of Professor Fairchild to the chair of natural history at the University of Rochester, the academy has lost one of its most active members, — a loss which will be felt for a long time to come. The publications of the academy have been pushed forward most energetically, and the active editor, Professor Martin, has succeeded in bringing them up to date, their value being thus greatly enhanced. Mr. George F. Kunz sent in an interesting paper on recent mineralogical discoveries, and several members reported on the results of journeys undertaken during last summer's vacation. Dr. H. Carrington Bolton made some interesting remarks on German and Austrian libraries which he had visited in pursuance of bibliographical studies, and dwelt on the defects of the systems of several of these libraries. On the other hand, he described the management of the library of Strassburg as worthy of the highest commendation. The arrangement is thoroughly systematical. Visitors are allowed the greatest possible facilities, and any citizen of Alsace Lorraine applying for books is entitled to have them sent to his house, whether he lives in Strassburg or in some other part of the province. Dr. Brinton gave a brief description of his studies in English collections and libraries, and noted a large collection from Bolivia which is said to contain an unexpectedly large number of species and genera unknown to science. After a brief discussion of the trap rocks of Pennsylvania and New York, Dr. F. Boas gave a sketch of the ethnological results of his journey to British Columbia, during which he visited most of the peoples of that province.

—The committee on publications and lectures, of the Massachusetts Society for promoting Good Citizenship, have issued a circular requesting the clergymen of Massachusetts to prepare and preach, and as far as possible publish, between now and the general election in November, at least one sermon on the duties and responsibilities of American citizenship.

—A study undertaken by W. von Bezold a number of years ago made it probable that thunder-storms have a period corresponding to that of the rotation of the sun. In his inquiry he had used the material collected at the meteorological stations of Bavaria. As, however, an influence of this kind seemed very improbable, he did not publish the results of his researches. Recently Hertz, Wiedemann, Arrhenius, and others have shown that by the influence of radiation the conductivity of the air is changed, and thus a period of the frequency of thunder-storms corresponding to that of the rotation of the sun does not appear improbable. For this reason Von Bezold has taken up his earlier researches, and carefully scrutinized the observations of thunder-storms in Bavaria and Wurtemberg from 1880 to 1887. The *Naturwissenschaftliche Rundschau* reports on a paper on this subject read by Von Bezold before the Berlin Academy of Science. He finds that a period exists; and the proofs he gives are so convincing, that he feels encouraged to pursue this subject more fully.

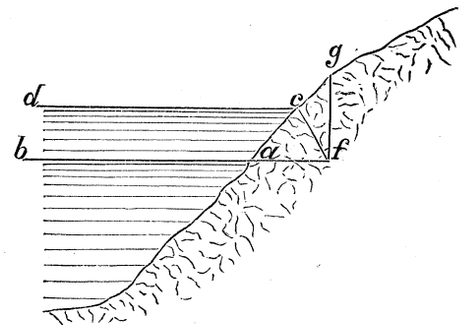
LETTERS TO THE EDITOR.

Floods in the Lower Mississippi.

MAJOR POWELL, in his letter to the New Orleans Chamber of Commerce, suggests as a means of regulating the lower Mississippi the erection of large basins at the head waters of its tributaries in the Rocky Mountains. "The cutting-power of a stream," he says, "increases rapidly with an increase of sedimentary load."

If this be correct, then there must be an increase in either quantity or in velocity by the increasing sedimentary load, those two constituting the working energy of the water, which is: quantity times half the square of the velocity. As to the quantity, there is, in fact, an increase. Draw a cubic foot of water from the river and let it rest. The sediment will settle to the bottom, and is therefore heavier than the amount of water it displaces, as otherwise it would remain in suspension. For this reason a cubic foot of water mixed with sediment is heavier than a cubic foot of clear water.

But how is it that this same sediment was in suspension in the same water when it was in the river? Because the water there had velocity. Velocity has an equivalent in 'head' or water weight



and just as much of this head will be used to carry along the surplus weight of the sediment as is equivalent to this surplus. Diminished head is diminished velocity. Clear water, therefore, will flow quicker (that is, have more working energy) than water mixed with sediment, which will readily be seen when we imagine such an amount of sediment to be added to the water that it would attain the consistency of sirup.

If, now, as Major Powell claims, the product of the two is increased by the increase of sediment, then the gain in weight of the quantity ought to be greater than the loss in velocity. This is not likely, for the reason that the velocity in that product is squared, and every loss in it, therefore, is squared too. It is furthermore not likely, because every gain in weight creates an additional loss in head, part of the latter being used to crush and pulverize the increase of sediment from heavy bowlders in the mountains into fine sand at the mouth of the river. There is only one grand total of power corresponding to a certain head, and every deduction from it is a loss which cannot be made up for again.

The indisputable fact that rivers choked by sediment do more lateral cutting than cleaned rivers, therefore, does not seem to be exactly expressed by attributing this fact to an increase in cutting-power of the water through sediment. If it is, Major Powell should prove it.

Again the letter reads, "The waters of the Missouri come loaded with materials which go on cutting and grinding with constantly increasing energy in their journey to the sea, choking the channel and cutting away the land." I should like to see this sentence more fully explained, as I fail to understand its full meaning.

As a matter of fact, there are other causes besides the action of sediment which increase the amount of river-sediment by bank-

cutting, but the crumbling of banks to a large extent is caused by the dissolving-power of water. Loam, clay, and silt as a rule largely constitute the banks of rivers. Water coming into contact with loam at a point *e* will destroy its cohesion, and carry it away. The water falling from level (*e d*) to *a b* eats into the bank as far as *f*, and the whole body (*f e g*), deprived of its support, will tumble down into the river as soon as it is sufficiently heavy to overcome the cohesion along *g f*; this irrespective of any sediment being mixed with the water, as pure water will destroy the cohesion of those materials in exactly the same way as water loaded with sediment.

The same effect is produced by frost. If bank-material saturated with water freezes up, its cohesion is destroyed. The spring freshets will carry it away.

Another instance of this kind is a bank consisting of layers resting on an inclined clay seam. When for some reason the seam becomes exposed to water, this will moisten its surface and transform it into a slippery mass, thus causing the overlying strata to slide into the river.

Therefore, suppose the head waters of all the tributaries of the Mississippi to furnish an entirely clear supply of water. It enters the river-channel. Immediately it picks up such sediment as its velocity enables it to carry. More sediment is added by the causes presented, — the old condition!

There are other remedies of long-established repute, which, if not by the same constructions, in principle certainly, will be just as practical here as anywhere else.

"The prime end to be sought," so Major Powell correctly puts it, "in order to prevent destructive floods, is to prevent the choking of the channel;" and again, "The real problem is to relieve the river of its excess of sediment." In these views engineers will fully concur. The letter touches upon one of these remedies: "Much of a coarser sediment is left to add to the geological growth of the region, while vast quantities pass on to the sea." The end to be sought, then, is to reverse this condition, and make the vast quantities add to the geological growth of the region. This can be accomplished by fixing, protecting, and in that way solidifying, large deposits which are now in constant migration, and preventing their being transformed again into floating sediment. To this end force the river into a channel, which removes the deposits from the current.

The sediment contributed by the tributaries now is only a trifle as compared with the amount centuries have accumulated in the beds of the Missouri and Mississippi. To make these enormous quantities *terra firma* is more effective than to clean the mountain waters, because the effect will be felt right there where the work is done, and at once.

Another means of making the sediment add to the geological growth of the region is this: Create a strip of 'dead' water on both banks all along the entire extent of the rivers in open and direct connection with the current. There will be a constant exchange of water between the current, where the water is loaded with sediment, and these bodies of standing water; and whatever water from the current gets into this strip will deposit its sediment. Then it returns into the river, is reloaded with detritus, and reenters the strip of standing water. Thus a destructive agency will be turned into a useful tool, carrying along sediment to add to the geological growth of the region. In course of time this strip will be completely filled, and then the water will not only flow in a concentrated channel, but there will also have been formed a terrace at the foot of the old bank, which protects it. This is the really effective settling-basin, and the thousands of miles of river-banks are the places where they must be constructed, because they do the work right on the spot where it is needed.

JULIUS MEYER, C.E.

Cleveland, O., Sept. 18.

Chalchiuitl: A Note on the Jadeite Discussion.

THE jadeite discussion is evidently not yet terminated. In the *American Anthropologist* for July, 1888, Dr. A. B. Meyer of Dresden maintains his position "that the nephrite (jadeite) question is not an ethnologic problem," the mineral occurring wherever the *artefacts* from it are found; while at the recent meeting of the American Association for the Advancement of Science, August, 1888, Prof. F. W. Putnam of Cambridge reiterated his belief, already expressed in the reports of the Peabody Museum, that the specimens of jadeite from Mexico and Central America were originally brought from Asia.

Jade first became known to modern Europeans by the specimens brought from Mexico, as the origin of the name attests (Spanish, *piedra de ijada*, so called from its supposed virtues in colic, *mal de ijada*), and therefore the references to it in the early writers on Mexico merit special attention. These have been partly collated by E. G. Squier, in his 'Observations on a Collection of Chalchihuitls' (*Annals of the Lyceum of Natural History*, New York, 1869), and later by Professor Fischer in his well-known volume 'Nephrit und Jadeit.' In verifying these quotations, I find that some important authorities have been altogether omitted, and others only partially reported. No direct reference is made to the Codex Mendoza; and Squier omits some of the most important observations of Sahagun, to wit, those referring to the *provenance* of these minerals, — the very point which, in the present stage of the question, we wish light upon. The practical bearing of this point will be readily appreciated when I add that the statement was made at the meeting of the American Association in August, that last winter an expert was sent to Mexico at considerable expense for the sole purpose of discovering the locality of the jadeite, but his search was vain.

The Nahuatl (Mexican) name for jadeite is *chalchiuitl*. This appears to have been applied to any greenish, partially transparent stone capable of receiving a handsome polish. All such were highly esteemed. Specific distinctions were established between such precious minerals by descriptive adjectives, as follows: —

Iztac chalchiuitl, white chalchiuitl; of a fine green, quite transparent, without stripes or stains.

Quetzal chalchiuitl, precious chalchiuitl; white, much transparency, with a slight greenish tinge, somewhat like a jasper.

Tlilayotic, literally, 'of a blackish watery color;' with mingled shades of green and black, partially transparent (chlormelanite?).

Tolteca-iztli, literally 'Toltec knife,' or 'Toltec obsidian;' of a clear, translucent green, and 'very beautiful.'

These are the descriptions of Bernardino de Sahagun (*Historia de la Nueva España*, Lib. XI. cap. 8), probably the source of all other writers upon this subject. He is not very exact as to the localities in which they were found by the natives. The first-mentioned, however, the white chalchiuitl, he states was obtained from quarries in the vicinity of Tecalco. This town, which I do not find on late maps, was in the state of Puebla, and it may be the modern Tecali mentioned by Orozco y Berra in that state (*Geografia de las Lenguas Indijenas de Mejico*, p. 211). It would be worth while searching in that vicinity.

With reference to the last-mentioned variety, the Toltec stone, Sahagun makes a noteworthy remark, not quoted by Squier, which, so far as it goes, is certainly in favor of the view that this valued variety was not from any deposit known to the natives. This beautiful species of chalchiuitl, he says, did at one time exist in this country (New Spain), "and does yet, *as is proved by the pieces obtained from the ancient edifices*." In other words, no deposit was known to the natives of his day, and such fragments as they possessed were exhumed from the ruins of the ancient cities.

The Codex Mendoza is a copy of the tribute-roll of the ancient Mexican Empire (published in LORD KINGSBOROUGH'S *Mexican Antiquities*). It defines the tax from each district, naming the cities. Strings of chalchiuitl are mentioned as part of the tribute from a number of localities, and refer evidently to small rounded pieces used as beads, and obtained from the sands of streams. Only from one district are large pieces of chalchiuitl demanded. These, three in number each year, were required from Tototepec, Chinantlan, and other towns situate in the present state of Oaxaca, and principally in the department of Vilalta (Zoochila). Mühlenpfordt describes this region as mountainous and wild, inhabited by the Mixe Indians and the Chinantecas (*Schilderung der Republik Mejico*, Bd. II. s. 213, 214). This is the spot to which the explorer should penetrate if he would discover the locality of the large pieces of Mexican jadeite.

D. G. BRINTON.

Media, Penn., Sept. 28.